

What is Claimed is:

1. A rechargeable battery, comprising
at least one anode;
at least one cathode, each said cathode being in
opposing spaced relationship to each said anode;
two layers of differing porous separators/binders
intermediate each opposing anode and cathode to maintain said
spacing and to bind each anode to each cathode;
a non-aqueous electrolyte filling said pores of said
layers of separator/binder;
wherein: a first separator/binder comprises a mixture
of polymer P_1 and a particulate material M_1 ,
a second separator/binder comprises a mixture of
polymer P_2 and a particulate material M_2 ,
polymer P_1 is soluble in a solvent S_1 ,
polymer P_2 is soluble in a solvent S_2 ,
polymer P_1 is non-soluble in the solvent S_2 ,
polymer P_2 is non-soluble in the solvent S_1 ,
particulate material M_1 is non-soluble in solvent S_1 ,
and
particulate material M_2 is non-soluble in solvent S_2 .

2. A rechargeable battery according to Claim 1,
wherein said at least one anode and said at least one cathode
are stacked as a prismatic stacked structure.

3. A rechargeable battery according to Claim 1,
wherein
said battery has one anode and one cathode, and
said anode and cathode are formed as a cylindrical
wound structure.

4. A rechargeable battery according to Claim 2,
wherein
a plurality of anodes and cathodes are stacked, and
the stacking sequence is a repetition of (anode) -
(first separator/binder) - (second separator/binder) - (cathode) -
(first separator/binder) - (second separator/binder) - (anode).

5. A rechargeable battery according to Claim 2,
wherein
a plurality of anodes and cathodes are stacked, and
the stacking sequence is a repetition of (anode) -
(first separator/binder) - (second separator/binder) - (cathode) -
(second separator/binder) - (first separator/binder) - (anode).

6. A rechargeable battery according to Claim 2,
wherein a plurality of anodes and cathods are stacked, and the
stacking sequence is a repitition of (cathode) - (first
separator/binder) - (second separator/binder) - (anode) - (second
separator/binder) - (first separator/binder) - (cathode).

7. A rechargeable battery according to Claim 3,
further comprising

a core upon which said anode and cathode are wound to
form said cylindrical wound structure.

8. A rechargeable battery according to Claim 7,
wherein the shape of the core is one selected from: a cylinder
and a hexahedron.

9. A rechargeable battery according to Claim 1,
wherein

solvent S_1 is of the hydrophobic type, and
solvent S_2 is of the hydrophilic type.

10. A rechargeable battery according to Claim 1,
wherein

solvent S_1 and solvent S_2 are of the hydrophobic type,
or solvent S_1 and solvent S_2 are of the hydrophilic type.

11. A rechargeable battery according to Claim 9,
wherein

the hydrophobic solvent S_1 is one selected from:
heptane, tetrahydrofuran, DMF, and DMSO, and

the hydrophilic solvent S_2 is one selected from:
methanol, ethanol, and methanol/chloroform.

12. A rechargeable battery according to Claim 10,
wherein

the hydrophobic solvents S_1 and S_2 are selected from:
heptane, tetrahydrofuran, DMF, and DMSO, or

the hydrophilic solvents S_1 and S_2 are selected from:
methanol, ethanol, and methanol/chloroform.

13. A rechargeable battery according to Claim 1,
wherein

polymer P_1 is at least one selected from: PE, PP, PVC,
polystyrene, and PAN; and

polymer P_2 is at least one selected from: PEO, PPO,
polycarbonate, PMMA, and PVP.

14. A rechargeable battery according to Claim 1,
wherein particulate materials M_1 and M_2 are selected from:
silicon dioxide, magnesium oxide, calcium oxide, strontium
oxide, barium oxide, boron oxide, aluminum oxide, silicon oxide;
synthetic or natural zeolites, borosilicate, calcium
silicate, aluminum polysilicates, wood flours, glass microbeads,
glass hollow microspheres, polyester fibers, nylon fibers, rayon
fibers, acetate fibers, acrylic fibers, polyethylene fibers,
polypropylene fibers, polyamide fibers, polybenzimidazole
fibers, borosilicate glass fibers, and wood fibers.

15. A rechargeable battery according to Claim 14,

wherein particulate materials M_1 and M_2 are the same or M_1 and M_2 are different.

16. A rechargeable battery according to Claim 1,
wherein

in the first separator/binder the percent by weight of
the particulate material is between 50% and 98%; and

in the second separator/binder the percent by weight
of the particulate material is between 50% and 98%.

17. A rechargeable battery according to Claim 1,
wherein

in the first separator/binder the percent by weight of
the particulate material is between 80% and 97%; and

in the second separator/binder the percent by weight
of the particulate material is between 70% and 92%.

18. A rechargeable battery according to Claim 13
wherein polymer P_1 and/or polymer P_2 are/is a combination of two
or more polymer materials.

19. A rechargeable battery according to Claim 14
wherein particulate material M_1 and/or particulate material M_2
are/is a combination of two or more particulate materials.

20. A rechargeable battery according to Claim 1,
wherein the first separator/binder is of a thickness in the

range of 10-200 μm , and

the second separator/binder is of a thickness in the range of 10-200 μm .

21. A rechargeable battery according to Claim 1, wherein the first separator/binder is of a thickness in the range of 30-60 μm , and

the second separator/binder is of a thickness in the range of 30-60 μm .